EFFICACY OF SUSTAINED PASSIVE STRETCHING ALONG WITH COUNTER TRACTION ON THE INFERIOR CAPSULE OF THE SHOULDER JOINT IN THE MANAGEMENT OF A FROZEN SHOULDER

Dissertation submitted to

The Tamil Nadu Dr. M.G.R. Medical University

Chennai

In fulfillment of the requirements for the degree of

MASTER OF PHYSIOTHERAPY

(Physiotherapy in Orthopaedics)

Reg. No. 271710002

May – 2019

COLLEGE OF PHYSIOTHERAPY

SRI RAMAKRISHNA INSTITUTE OF PARAMEDICAL SCIENCES(SRIPMS)

COIMBATORE – 641044

CERTIFICATE

This is to certify that the dissertation work entitled **"Efficacy of sustained passive stretching along with counter traction on the inferior capsule of the shoulder joint in the management of a frozen shoulder''** was carried out by the candidate bearing the **Register No.271710002 (May 2019)** in College of Physiotherapy, SRIPMS, Coimbatore, affiliated to the Tamil Nadu Dr. M.G.R Medical University, Chennai towards fulfillment of the **Master of Physiotherapy (Orthopaedics).**

Prof. B. SANKAR MANI, MPT (Sports)., MBA.,
Principal
College of Physiotherapy
SRIPMS
Coimbatore – 641044

Place: Coimbatore

Date:

CERTIFICATE

This is to certify that the dissertation work entitled **"Efficacy of sustained passive stretching along with counter traction on the inferior capsule of the shoulder joint in the management of a frozen shoulder''** was carried out by the candidate bearing the **Register No. 271710002 (May 2019) i**n College of Physiotherapy, SRIPMS, Coimbatore, affiliated to the Tamil Nadu Dr. M.G.R Medical University, Chennai towards fulfillment of the **Master of Physiotherapy (Orthopaedics)** under my direct supervision and guidance.

Prof .V.S. Seetharaman, MPT (Ortho).,
GUIDE
College of physiotherapy
SRIPMS
Coimbatore – 641044.

Place: Coimbatore

Date:

CERTIFICATE

This is to certify that the dissertation work entitle **" Efficacy of sustained passive stretching along with counter traction on the inferior capsule of the shoulder joint in the management of a frozen shoulder''** was carried out by the candidate bearing the **Register No. 271710002 (May 2018)** College of Physiotherapy, SRIPMS, Coimbatore affiliated to The Tamil Nadu Dr. M.G.R Medical University, Chennai towards fulfillment of the requirements for the degree of **Master of Physiotherapy (Orthopaedics)** was evaluated.

INTERNAL EXAMINER **EXTERNAL EXAMINER**

Place:

Date:

ACKNOWLEDGEMENT

With great privilege I express my deep sense of gratitude to the **God Almighty** for his blessings, love and care for me and who have always been my source of inner strength and courage throughout my life.

From the bottom of my heart, I thank **my Mom & Dad**, **Beloved Sisters and my friends** for their concern and endless love for me in every part of my life.

With great honor, I dedicate this study to my guide **Prof. V.S.Seetharaman, MPT (Ortho).,** College of Physiotherapy, SRIPMS, Coimbatore**,** without whom this venture would have been impracticable. I am grateful to his inevitable role in organizing and completing the study with full support and patience.

This is my tribute to principal and my guide **Prof.B.SANKARMANI, MPT (Sports)., MBA.,** College of Physiotherapy, SRIPMS, Coimbatore**,** without whom this venture would have been impracticable. I am grateful to his inevitable role in organizing and completing the study with full support and patience.

I extend my sense of gratitude to all the **Staffs** of College of Physiotherapy, SRIPMS, for their timely help and valuable information for the betterment of my study.

I am fortunate by all students who made me trustworthy to involve with their precision ones who made the study very colorful.

I would like to acknowledge my Beloved Friends for their constant support in helping me to complete this study successfully.

I thank **Saraswathi Computer Centre,** Coimbatore, in particular for their defined and orderly execution of the dissertation work.

CONTENTS

ABBREVIATION

NPRS – numerical pain rating scale

OSS – oxford shoulder scale

ROM – range of motion

SD – standard deviation

1. INTRODUCTION

Frozen shoulder [also known as adhesive capsulitis] is a painful and disabling disorder characterized by the development of dense adhesions, capsular thickening, diminished glenoid cavity volume and capsular restrictions, especially in the dependent folds of the capsule. The connective tissue surrounding the glenohumeral joint of the shoulder complex becomes inflamed, stiff and greatly restricting motion causing chronic pain. The pain is usually constant and will become worse at night and cold weather.

Frozen shoulder was first described by Duplay in 1896 who called it "scapulohumeral periarthritis". Later in 1934, Codman coined the concept of "Frozen Shoulder". Nevertheless, current literature views this concept as very broad and it could cause confusion since it involves different pathologies which present as pain and shoulder stiffness; such as calcific tendonitis, bicipital tenosynovitis, break of the rotator cuff, glenohumeral and acromioclavicular arthritis. Neviaser, during the pre-arthroscopic era, was the first one to use the concept of "Adhesive Capsulitis", to describe findings of chronic inflammation and fibrosis of the joint capsule, although arthroscopic examination would support the term fibrotic capsulitis with absence of intra-articular adhesions. It is considered as a self limiting disease.

Incidence

- Mostly the age groups of 40 to 70 are affected.
- Comparatively women are affected than men [especially in postmenopausal women].
- Mostly shoulder affected unilaterally than bilaterally.
- Prevalence of the condition is estimated to be 2 to 5 % in the general population.
- 6 to 17 % of affected people, their another shoulder becomes affected within the 5 years.

Causes

- Primary frozen shoulder idiopathic in nature and radiographs appears normal.
- Secondary frozen shoulder develops due to some disease processes which can be classified as:
  - Systemic secondary frozen shoulder - Diabetics mellitus, Hypo or hyper thyroidism& Hypoadrenalism.
  - Extrinsic secondary frozen shoulder (it occurs pathology not related to shoulder) - Cardiopulmonary disease, Stoke, Cervical disc pathology, Humeral fractures & Parkinson's disease.
  - Intrinsic secondary frozen shoulder (it occurs from pathology related to shoulder) - Rotator cuff tendonopathy, Glenohumeral arthropathy & Acromio clavicular arthropathy.

Signs & Symptoms

- **Acute phase**
  - Pain is frequently experienced radiating below the elbow and may disturb sleep.
  - Tenderness can be elicited by palpating in the fornix immediately below the edge of the acromion process between the attachments of the posterior and middle deltoid.
- **Sub acute Phase**
  - Capsular tightness begins to develop.
  - The patient feels pain as end of the limited range is reached.
- **Chronic phase**
  - There is significant loss of function with an inability to reach over head, out ward or behind the back.

STAGES

Hannafin and Chiaia described four stages of frozen shoulder, including the arthroscopic stages described by Neviaser

- **Stage 1 Pre-Adhesive Stage:**
  - It is the painful phase, which is characterized by a gradual onset of symptoms. Symptoms persist for less than 3 months and consist of an aching pain referred to the deltoid insertion and inability to sleep on the affected side. Patients may report a mild limitation of ROM which invariably resolves with the administration of local anesthetic

- **Stage 2 Freezing Stage:**
  - When symptoms continue since 3 to 9 months and are characterized by nocturnal pain moreover when the patients lying on the affected side, furthermore a significant loss of both active and passive ROM is referred.

- **Stage 3 Frozen Stage:**
  - When symptoms persists since 9 to 14 months. The shoulder joint stiffness is predominant and pain may still be present at the end of motion or at night.

- **Stage 4 Thawing Stage:**
  - It is characterized by minimal pain and gradual improvement of ROM due to capsular remodeling. This stage occurs between 15 and 24 months.

Anatomy

- Shoulder joint is a synovial joint of the ball and socket variety. The joint formed by the glenoid cavity of scapula and the head of the humerus.
- Structurally it is a weak joint because the glenoid cavity is too small and shallow to hold the head of the humerus in place.

Biomechanics

- The glenohumeral joint have three rotatory and three translator degrees of freedom .It has a capsule and several associated ligaments and bursae.

Capsule & ligaments

- The glenohumeral joint is surrounded by large and loose capsule that is taut superiorly and slack anteriorly and inferiorly with the arm dependent at the side.
- The capsule tightens when the humerus is abducted and laterally rotated, making this the closed packed position for the glenohumeral joint.
- The capsular surface area is twice that of the humeral head, and more than 2.5 cm of distraction of the head from the glenoid fossa is possible in the loose packed position.
- Harryman and colleagues described the superior glenohumeral ligament, the superior capsule, and the coracohumeral ligament as interconnected structures that bridge the space between the supraspinatus and subscapularis muscle tendon and form the rotator interval capsule.

Joint Mobilization

- Joint mobilization techniques are skilled manual therapy inventions specifically applied to joint structures to modulate pain and treat joint impairments that limits ROM. They are passive skilled manual therapy techniques applied to joint and related soft tissues at varying speeds and amplitudes using physiological or accessory motions for therapeutic purposes.
- Joint mobilization techniques such as traction and glide are used to stretch the adhered capsule and improve the physiologic accessory movements. Traction involves distraction of one articular surface perpendicular to the other and gliding involves translational movement of one articular surface parallel to the other. These techniques are considered capable of stretching the particular connective tissues that may limit joint motion without impingement, resulting in an improvement of the limited ROM and reduction in pain.

- In the current study, we focused on a non invasive mobilization strategy incorporating the traction component of the shoulder by an external counter traction device to create an inferior capsular stretch. This study was to compare the effectiveness of inferior capsular stretching by a shoulder counter traction with conventional physiotherapy, assessing patients with a frozen shoulder based on ROM, pain, and shoulder function.

1.1 NEED FOR THE STUDY

The Physiotherapy management for a Frozen Shoulder consists of various methods to addresses pain and shoulder stiffness. For reducing pain – heat/ice application, ultrasound, interferential therapy, transcutaneous electrical nerve stimulation and pulsed electromagnetic field therapy are used. To correct shoulder stiffness – active and passive range of motion exercises, mobilization and manipulation techniques are used.

This study was aimed to investigate the effect of shoulder counter traction along with conventional physiotherapy in inferior capsule stretching and to compare with conventional physiotherapy alone benefits for treating a Frozen Shoulder.

1.2 OBJECTIVE OF THE STUDY

To evaluate the effectiveness of conventional physiotherapy with counter traction on pain, shoulder range of motion and shoulder function in a frozen shoulder.

1.3 STATEMENT OF PROBLEM

To study "Efficacy of sustained passive stretching along with counter traction on the inferior capsule of the shoulder joint in the management of a frozen shoulder".

1.4 EXPECTED OUTCOME

Based on the literature review, it is expected that the subject who were treated with conventional physiotherapy along with shoulder counter traction showed significant improvement in decreasing pain and increasing range of motion and functional activity of shoulder joint.

1.5 HYPOTHESIS

Null Hypothesis

There is no significant difference between the conventional physiotherapy and counter traction along with the conventional physiotherapy on pain, shoulder range of motion and shoulder function in a frozen shoulder.

Alternative Hypothesis

There is a significant difference between the conventional physiotherapy and counter traction along with the conventional physiotherapy on pain, shoulder range of motion and shoulder function in a frozen shoulder.

2. REVIEW OF LITERATURE

- **Panchal et al [2015]** this study demonstrated that end range mobilization, interferential current, stretching exercise and moist heat has better improvement in range of motion in acute stage of frozen shoulder.

- **MirsadAlkan et al [2015]** this study proved that frozen shoulder treated with interferential current, hot pack, ultrasound, stretching, strengthening and range of motion exercises comparing right and left side does not have difference in reducing pain and improving functional capacity.

- **Gerston et al [1955], Lehmann et al [1954]** stated that prior heating of the joint has found to facilitate relaxation and mobilization.

- **Timothy F Tyler et al [2010]** this study examined the goniometric range of motion measurement using universal goniometry for the shoulder appear to be highly reliable.

- **Leggin B G et al [2011]** this study shows responsiveness of the numerical pain rating scale for shoulder pain.

- **L M Olley and A J Carr [2008]** this study reported that oxford shoulder score questionnaire assess functional activity after rotator cuff repair in shoulder.

- **Ibrahim et al [2005]** conducted a study mobilization techniques versus a selected exercise program in the treatment of post traumatic frozen shoulder. He concluded that both the mobilization techniques and selected therapeutic exercise program used in this study proved efficiency in the treatment of patients with post traumatic adhesive capsulitis.

- **Wim R et al [2000]** conducted a study end range mobilization techniques in adhesive capsulitis of the shoulder joint. This study describe the use of end range mobilization techniques performed by physiotherapist were used in an effort to increase mobility in patients with adhesive capsulitis of shoulder. There was an increase of glenohumeral mobility.

- **Johnson et al [2007]** conducted a study on the effect of anterior versus posterior glide joint mobilization on external rotation ROM in patients with shoulder adhesive capsulitis. They selected 20 patients and allocated them into 2 groups of 10 each. Both groups were given ultrasound and ergometer, in addition group A was given anterior glide and group B was given posterior glide. They concluded that posterior glide was effective in improving external rotation ROM.

- **Goyal et al [2013]** conducted a study on combined effect end range mobilization and mobilization with movement techniques on range of motion and disability in frozen shoulder. This study concluded that the combination manual therapy end range of motion andmobilization with movement should be incorporated in the treatment protocol of frozen shoulder patients to achieve better gain in the ROM and shoulder pain disability index scores.

- **Asad et al [2013]** conducted a study on comparison of outcome of passive joint mobilization techniques with active assisted pulley exercise in patients with frozen shoulder in improving range of motion. This study proved passive joint mobilization and active assisted pulley exercise are equally effective used for increasing ROM in frozen shoulder patients

- **Henricus et al [2006]** a study on comparison of high grade and low grade mobilization techniques in the shoulder. High grade mobilization technique proved to be effective than low grade mobilization technique in the management of adhesive capsulitis of the shoulder.

- **Kazi et al [2007]** conducted a study on effectiveness of scapular stretching and strengthening exercises adhesive capsulitis patients attended at CRP. The results shows effectiveness of stretching and strengthening exercise of scapular muscles along with conventional physiotherapy to reduce the features of patients with adhesive capsulitis which will be helpful to facilitate their rehabilitation and to enhance functional activities.

- **Suzie et al [2015]** conducted a study on the efficacy of different type of mobilization techniques in patient with primary adhesive capsulitis of the shoulder. The result shows that mobilization techniques have beneficial effect in patients with primary adhesive capsulitis of the shoulder.

3. MATERIALS AND METHODOLOGY

3.1 STUDY DESIGN

- The study is an Experimental study.

3.2 STUDY SETTING

- The study was conducted at the Department of Sri Ramakrishna Hospital, under the staff supervision.
- All patients were considered for the study after informed consent was obtained.

3.3 STUDY DURATION

- The study duration was carried out for 6 months.

3.4 MATERIALS

- Universal goniometry
- Ultrasound machine
- Ultrasound gel and Cotton
- Overhead pulley apparatus
- Weight – 2 to 3kg
- Cuff and bandage – medium size
- Moist Hot pack
- Stool

3.5 TREATMENT DURATION

- Both group received treatment for a period of 2 weeks – 5 days in a week for 20 min of one session/day.

3.6 SELECTION CRITERIA

The subjects were eligible if they fulfilled the following criteria.

Inclusion Criteria

- Unilateral frozen shoulder
- Shoulder pain at night that often disturbed sleep
- Guarded shoulder movements
- Difficulty in reaching behind the back
- Restriction of shoulder movements – flexion or extension or abduction or adduction or internal rotation or external rotation or all
- Reduced arm swing with walking
- Rounded shoulders
- Stooped posture
- Ability to complete questionnaires

Exclusion Criteria

- Recent joint infection or surgery [less than 6 months]
- History of shoulder sub-luxation, dislocation or ligamentous injury
- Shoulder arthroplasty
- Shoulder impingement syndrome
- Trigger point in the upper trapezius
- Recent trauma
- Recurrent shoulder dislocation
- Subacute bursitis
- Rotator cuff syndrome
- Spondylosis with brachial neuralgia
- In & out fracture around scapula & shoulder
- Cervical neuralgia
- Superior labrum anterior to posterior tear
- Shoulder impingement syndrome

3.7 SAMPLING TECHNIQUE

- Convenience sampling

3.8 SAMPLE SIZE

- This study will involve 20 subjects (males & female)

3.9 METHOD OF COLLECTION OF DATA

A total of 50 subjects were initially recruited for the study. Among this 29 subjects were excluded according to various exclusive criteria. Thus 21 subjects were selected and assigned into two groups. GROUP A {Control Group} had 10 subjects and GROUP B {Experimental Group} had 11 subjects. After treatment started 1 subject were discontinued from GROUP B {Experimental Group} because subject was unable to came for more treatment sessions continuously.

At baseline of study, all subjects involved for pre-test assessment by universal goniometry, NPRS and OSS to know the shoulder range of motion, pain and shoulder function. After 2 weeks of training period, all subjects were reassessed using the same scale to know the post-test interventional score. Every week follow up evaluation have been done to know the progression.

3.10 TREATMENT TECHNIQUE

GROUP A {Control Group}

- This group will be given conventional physiotherapy.

GROUP B {Experimental Group}

- This group will be given shoulder counter traction along with conventional physiotherapy.

3.11 INTERVENTION PROTOCOL

GROUP A {Control Group}

TREATMENT SEQUENCE	TECHNIQUE USED	FREQUENCY PER SESSION
Warm up	Application of moist heat over the shoulder	2 minutes (approximately) per session
Mobilization	Inferior & posterior Glides (Grade 1 to 4)	8-12 repetitions in 4 sets per session
Electrotherapy Modality	Ultrasound for deep tissue effect	5 minutes (approximately) per session
Home Exercise Program	Forward flexion of the shoulder holding a stick (in sitting and standing position) Pendulum exercises (clockwise and counterclockwise) Wall climbing exercises while standing (facing forward and facing sideways) Functional exercises involving transfer of objects from one hand to other at various directions around the body, toweling behind the back with both hands alternatively, lifting and carrying objects using the affected shoulder.	10 repetitions each for 3 times per day

GROUP B {Experimental Group}

TREATMENT SEQUENCE	TECHNIQUE USED	FREQUENCY PER SESSION
Warm up	Application of moist heat over the shoulder	2 minutes (approximately) per session
Mobilization with countertraction (I): Position 1	Posteroanterior glides (Grades 1 to 4) followed by rotatory passive range of motion in internal and external rotation of glenohumeral joint to improve flexion range	4 to 5 glides followed by 4 to 5 rotatory passive range of motion for 3 to5 minutes (approximately) per session
Mobilization with countertraction (II): Position 2	Posteroanterior glides (Grades 1 to 4) followed by rotatory passive range of motion in internal and external rotation of glenohumeral joint to improve abduction range	4 to 5 glides followed by 4 to 5 rotatory passive range of motion for 3 to5 minutes (approximately) per session
Electrotherapy Modality	Ultrasound for deep tissue effect	5 minutes (approximately) per session
Home Exercise Program	Forward flexion of the shoulder holding a stick (in sitting and standing position) Pendulum exercises (clockwise and counterclockwise) Wall climbing exercises while standing (facing forward and facing sideways) Functional exercises involving transfer of objects from one hand to other at various directions around the body, toweling behind the back with both hands alternatively, lifting and carrying objects using the affected shoulder.	10 repetitions each for 3 times per day

3.12 OUTCOME TOOL & MEASURE

- Universal Goniometry – Shoulder Flexion and Abduction ROM
- Numerical Pain Rating Scale – Pain
- Oxford Shoulder Scale – Shoulder Function

3.13 STATISTICAL TOOL

Data collected from participants of the same group (intra group) were analyzed using paired‘t’ test and the difference between the two groups (inter group) were analyzed using independent‘t’ test. Differences were considered at significant level of 0.05%.

- Independent ‘t’ test:

The “t” value was calculated using the formula,

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s}\sqrt{\frac{n_1 n_1}{n_1 + n_1}}$$

$$S = \sqrt{\frac{\sum(x_1 - x_1^1)^2 + \sum(x_2 - x_2^1)^2}{n_1 + n_2 - 2}}$$

$$\delta = \sqrt{\frac{\Sigma d^2 - n(\sum d)^2}{n-1}}$$

- Paired ‘t’ test:

The “t” value was calculated using the formula,

$$\text{‘t’} = \frac{(\sum D)/N}{\sqrt{\frac{\sum D^2 - \frac{\sum D^2}{N}}{(N-1)(N)}}}$$

4. DATA PRESENTATION, ANALYSIS & INTERPRETATION

TABLE 1.1

Numerical Pain Rating Scale for GROUP A {Control Group}

S.No	Pre test	Post test
1	9	7
2	7	5
3	10	7
4	8	6
5	9	7
6	8	6
7	7	5
8	10	8
9	9	7
10	8	5

TABLE 1.2

Numerical Pain Rating Scale Scoring for Control Group

Outcome measure	Control Group	Mean	Standard deviation	Calculated 't' value	P value
NPRS	**PRE TEST**	8.50	1.08	4.5973	0.0002
	POST TEST	6.30	1.06		

GRAPH 1.2

Numerical Pain Rating Scale Scoring for Control Group

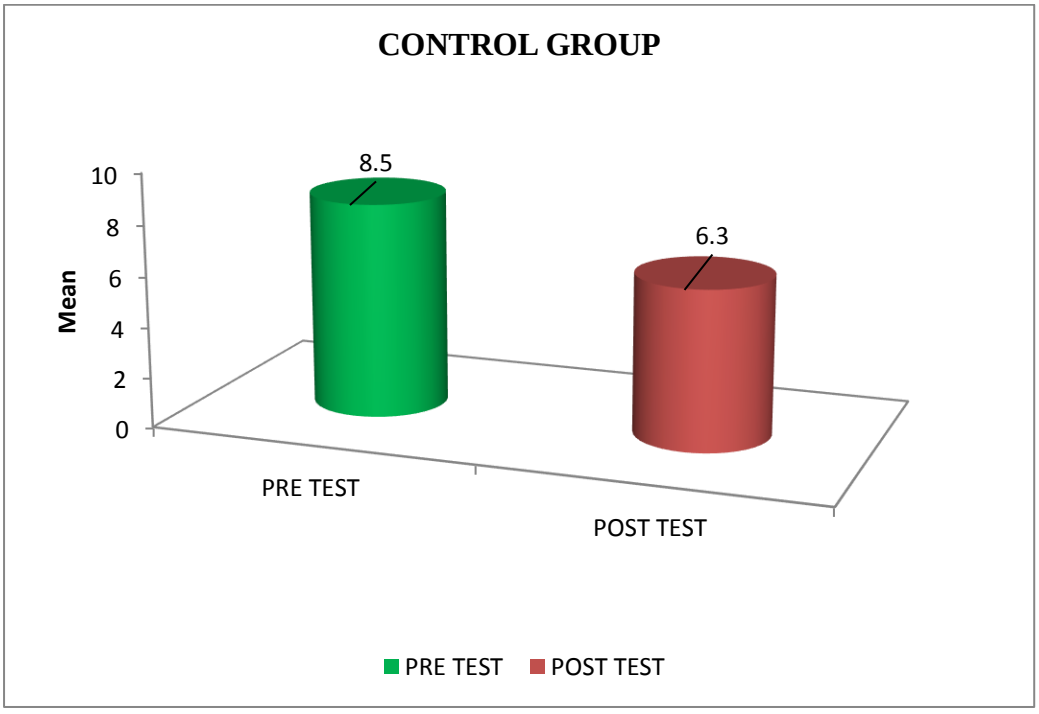


TABLE 1.3

Numerical Pain Rating Scale for GROUP B {Experimental Group}

S.No	Pre test	Post test
1	10	6
2	8	4
3	9	5
4	10	6
5	7	3
6	9	5
7	8	4
8	7	3
9	10	5
10	9	4

TABLE 1.4

Numerical Pain Rating Scale Scoring for Experimental Group

Outcome measure	Experimental Group	Mean	Standard deviation	Calculated 't' value	P Value
NPRS	PRE TEST	8.70	1.16	8.3799	<0.0001
	POST TEST	4.50	1.08		

GRAPH 1.4

Numerical Pain Rating Scale Scoring for Experimental Group

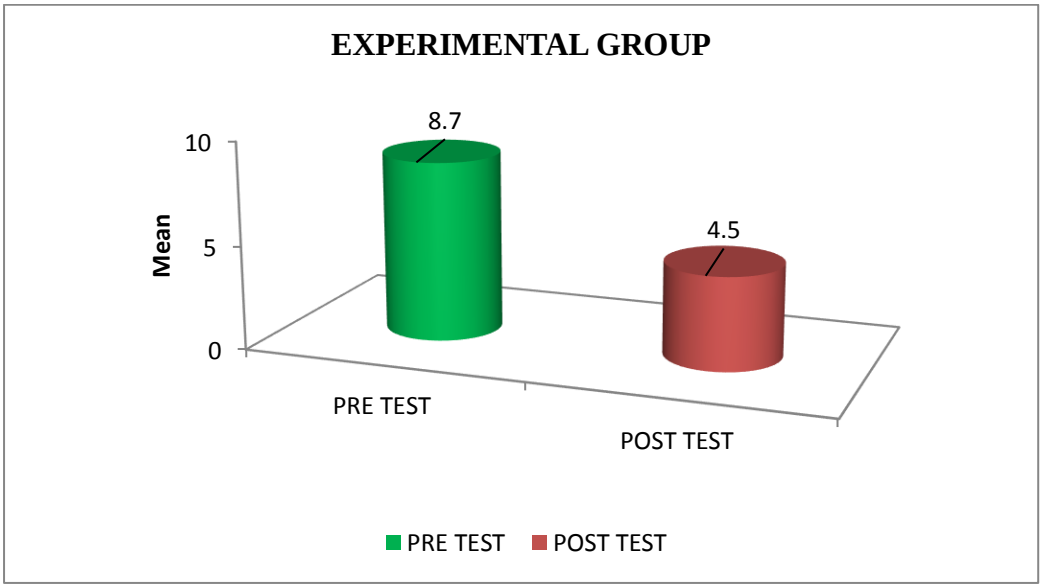


TABLE 1.5

Numerical Pain Rating Scale Scoring for

Control Group & Experimental Group

Outcome measure	Control Group		Experimental Group		Calculated 't' value	P value
	Mean	SD	Mean	SD		
PRE TEST	8.50	1.08	8.70	1.16	0.3990	0.6946

GRAPH 1.5

Numerical Pain Rating Scale Scoring for

Control Group & Experimental Group

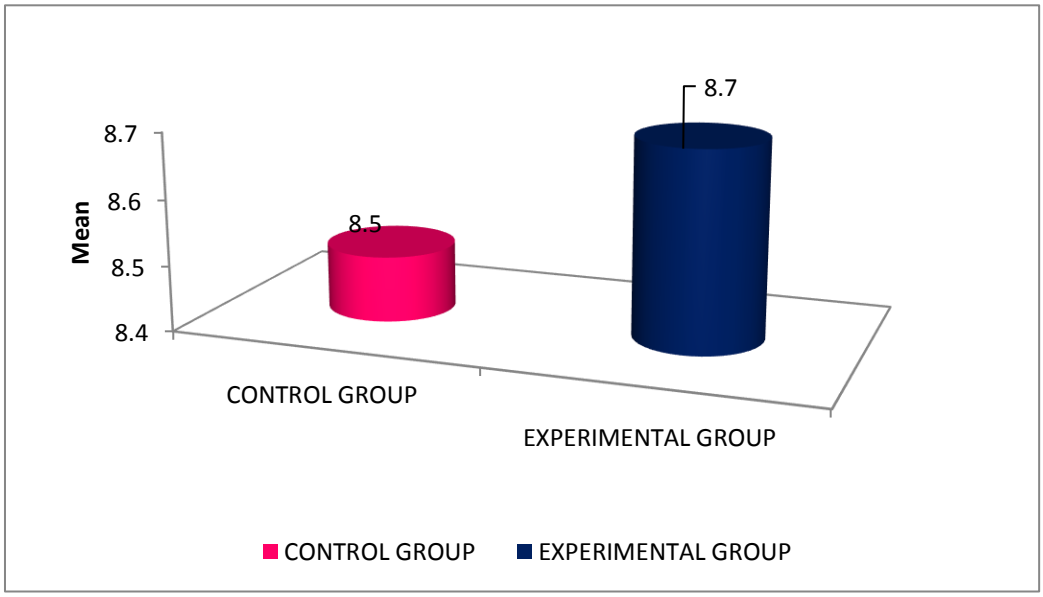


TABLE 1.6

Numerical Pain Rating Scale Scoring for

Control Group & Experimental Group

Outcome measure	Control Group		Experimental Group		Calculated 't' value	P value
	Mean	SD	Mean	SD		
POST TEST	6.30	1.06	4.50	1.08	3.7614	0.0014

GRAPH 1.6

Numerical Pain Rating Scale Scoring for

Control Group & Experimental Group

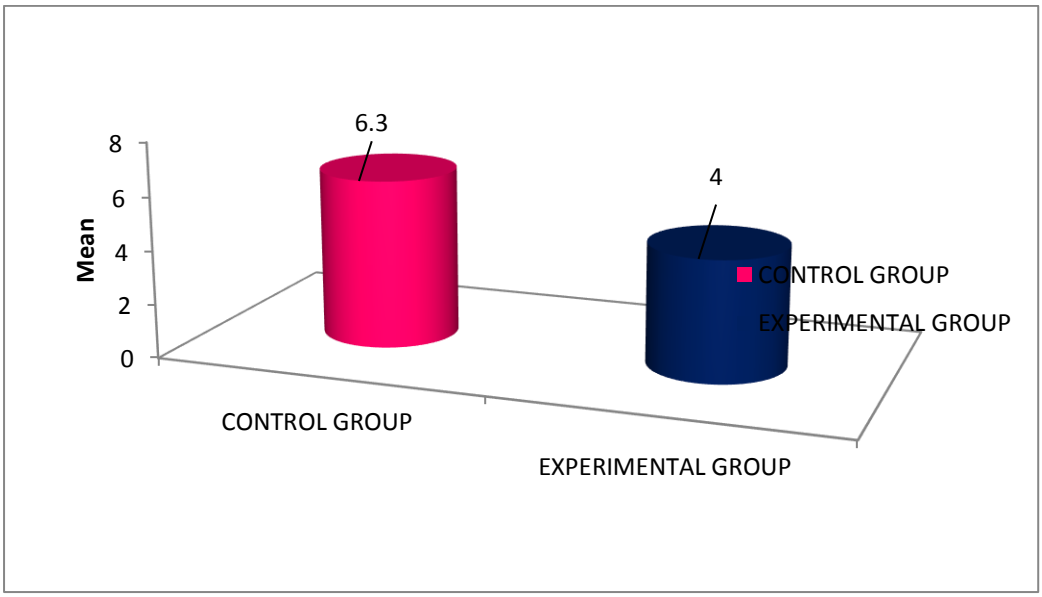


TABLE 2.1

Oxford Shoulder Scale for GROUP A {Control Group}

S.No	Pre test	Post test
1	25	37
2	21	42
3	28	39
4	23	43
5	19	30
6	27	45
7	24	38
8	20	41
9	26	46
10	22	44

TABLE 2.2

Oxford Shoulder Scale Scoring for Control Group

Outcome measure	Control Group	Mean	Standard deviation	Calculated 't' value	P value
OSS	**PRE TEST**	23.50	3.03	9.6157	<0.0001
	POST TEST	40.30	4.62		

GRAPH 2.2

Oxford Shoulder Scale Scoring for Control Group

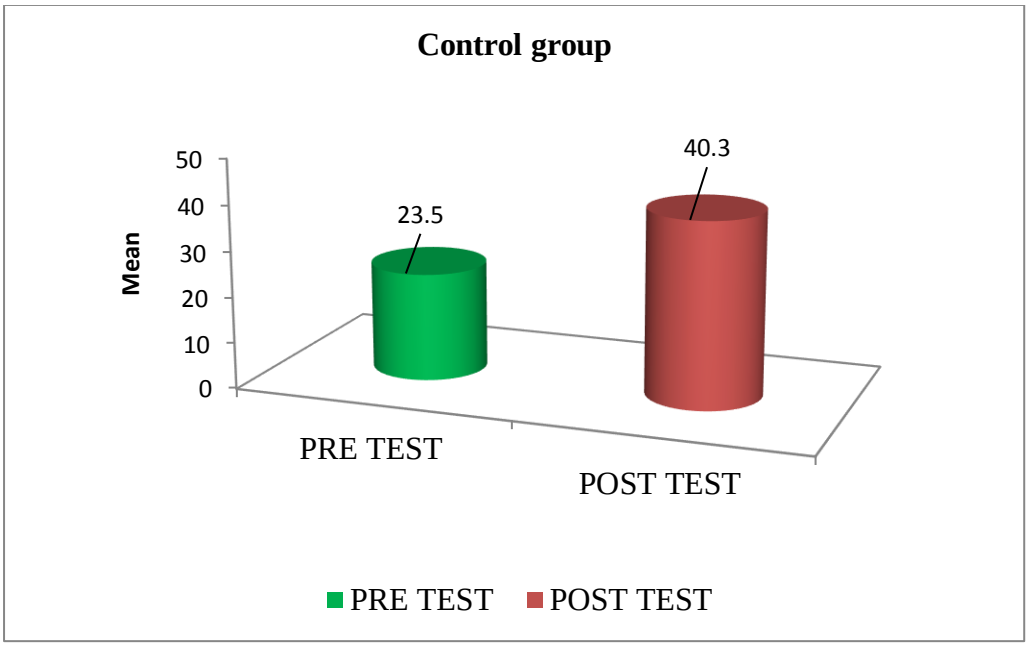


TABLE 2.3

Oxford Shoulder Scale for GROUP B {Experimental Group}

S.No	Pre test	Post test
1	22	34
2	27	39
3	21	33
4	19	31
5	25	36
6	26	37
7	20	32
8	23	35
9	18	30
10	24	38

TABLE 2.4

Oxford Shoulder Scale Scoring for Experimental Group

Outcome measure	Experimental Group	Mean	SD	Calculated 't' value	P Value
OSS	PRE TEST	22.50	3.03	4.6475	<0.0001
	POST TEST	34.50	3.03		

GRAPH 2.4

Oxford Shoulder Scale Scoring for Experimental Group

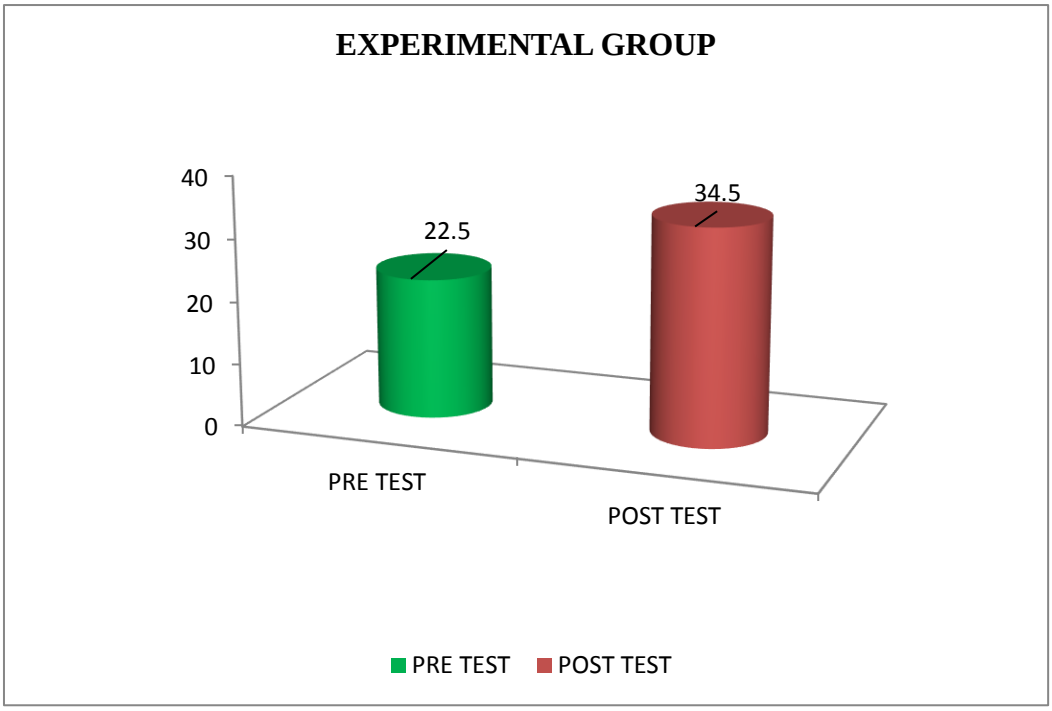


TABLE 2.5

Oxford Shoulder Scale Scoring for Control Group & Experimental Group

Outcome measure	Control Group		Experimental Group		Calculated 't' value	P value
	Mean	SD	Mean	SD		
PRE TEST	23.50	3.03	22.50	3.03	0.7380	0.4700

GRAPH 2.5

Oxford Shoulder Scale Scoring for Control Group & Experimental Group

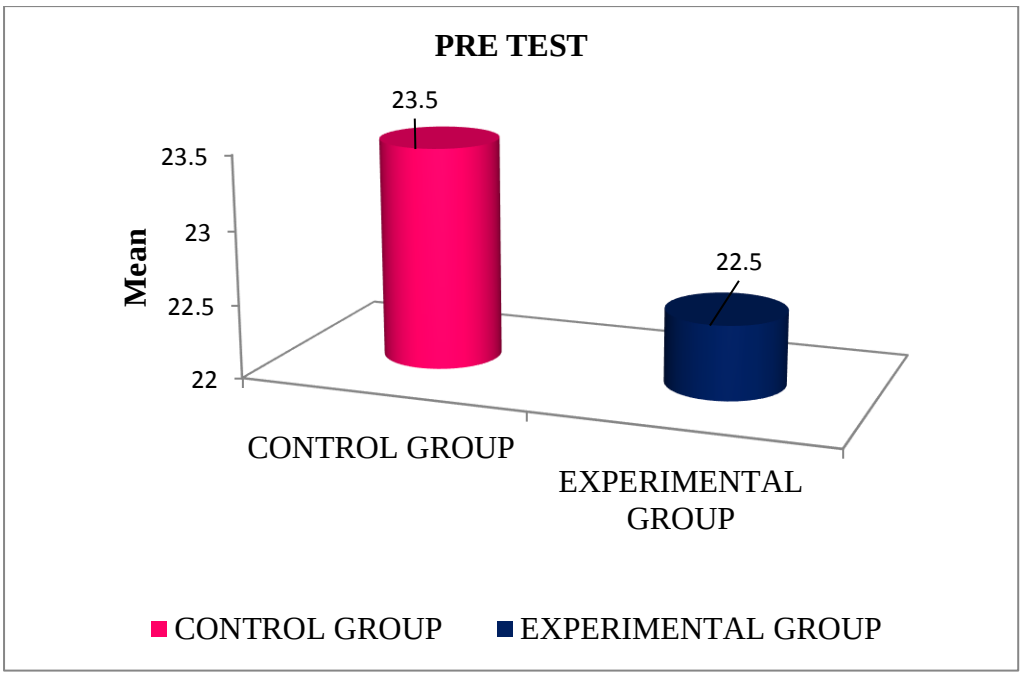


TABLE 2.6

Oxford Shoulder Scale Scoring for Control Group & Experimental Group

Outcome measure	Control Group		Experimental Group		Calculated 't' value	P value
	Mean	SD	Mean	SD		
POST TEST	40.30	4.62	34.50	3.03	3.3197	0.0038

GRAPH 2.6

Oxford Shoulder Scale Scoring for Control Group & Experimental Group

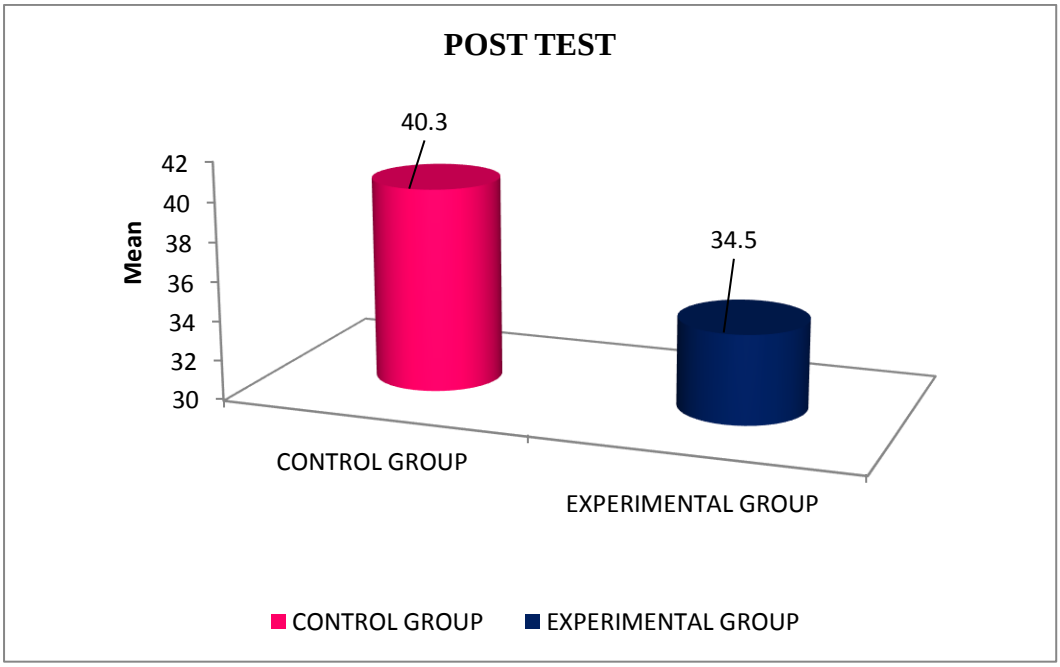


TABLE 3.1

Shoulder Flexion ROM for GROUP A {Control Group}

S.No	Pre test	Post test
1	85	104
2	98	117
3	73	92
4	97	116
5	89	108
6	102	125
7	79	102
8	95	118
9	106	129
10	82	105

TABLE 3.2

Shoulder Flexion ROM Scoring for Control Group

Outcome measure	Control Group	Mean	SD	Calculated 't' value	P value
FLEXION	**PRE TEST**	90.60	10.72	4.2516	0.0005
	POST TEST	111.60	11.36		

GRAPH 3.2

Shoulder Flexion ROM Scoring for Control Group

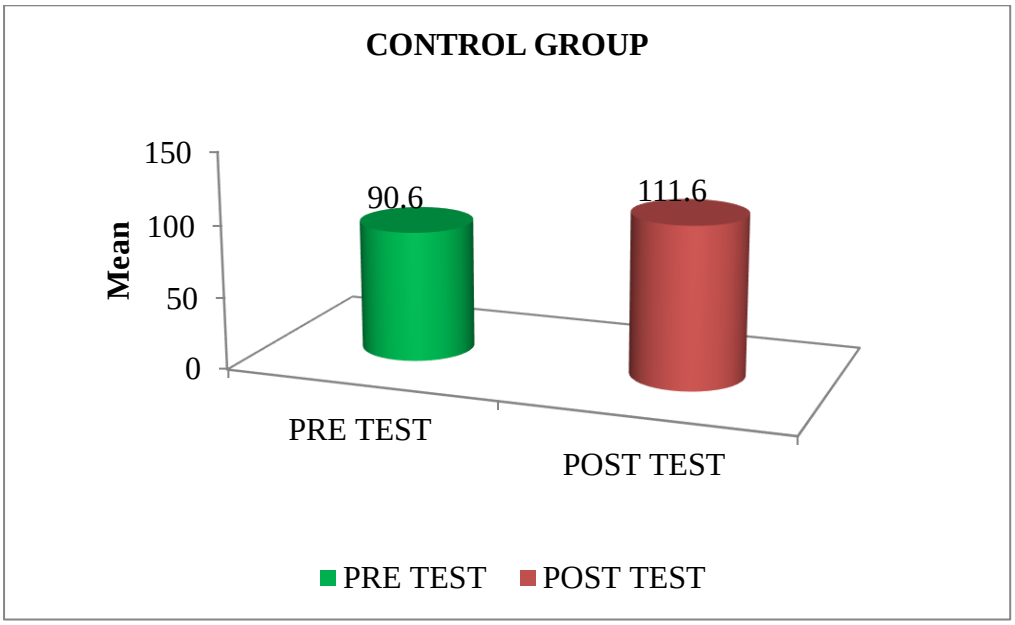


TABLE 3.3

Shoulder Flexion ROM for GROUP B {Experimental Group}

S.No	Pre test	Post test
1	92	139
2	87	134
3	94	141
4	79	126
5	98	145
6	83	137
7	103	157
8	75	129
9	96	150
10	107	161

TABLE 3.4

Shoulder Flexion ROM Scoring for Experimental Group

Outcome measure	Experimental Group	Mean	SD	Calculated 't' Value	P value
FLEXION	**PRE TEST**	91.40	10.34	10.3461	0.0001
	POST TEST	141.90	11.46		

GRAPH 3.4

Shoulder Flexion ROM Scoring for Experimental Group

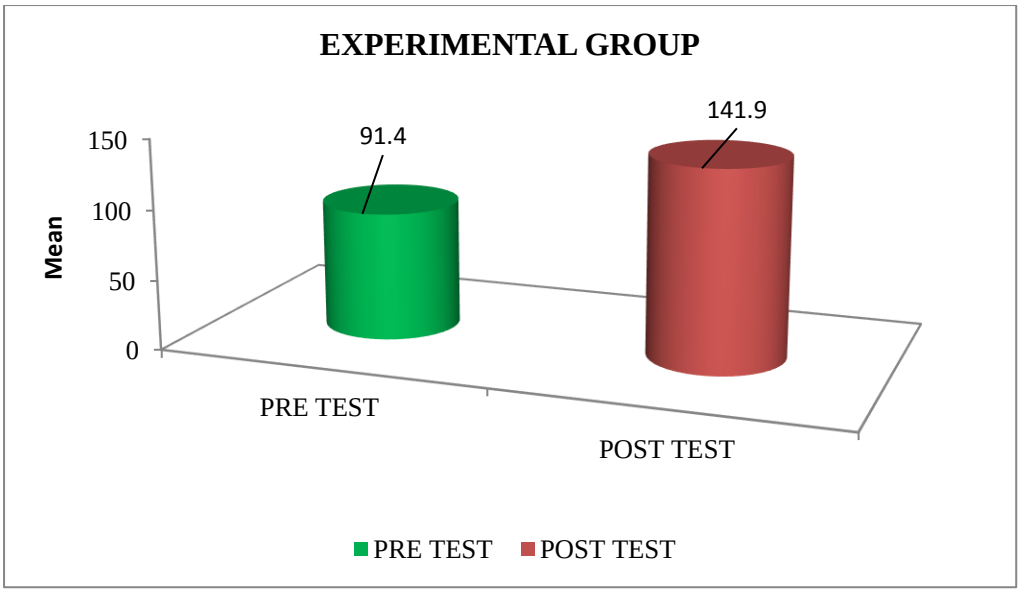


TABLE 3.5

Shoulder Flexion ROM Scoring for Control Group & Experimental Group

Outcome measure	Control Group		Experimental Group		Calculated 't' value	P value
	Mean	SD	Mean	SD		
PRE TEST	90.60	1O.72	91.40	10.34	0.1699	0.8670

GRAPH 3.5

Shoulder Flexion ROM Scoring for Control Group & Experimental Group

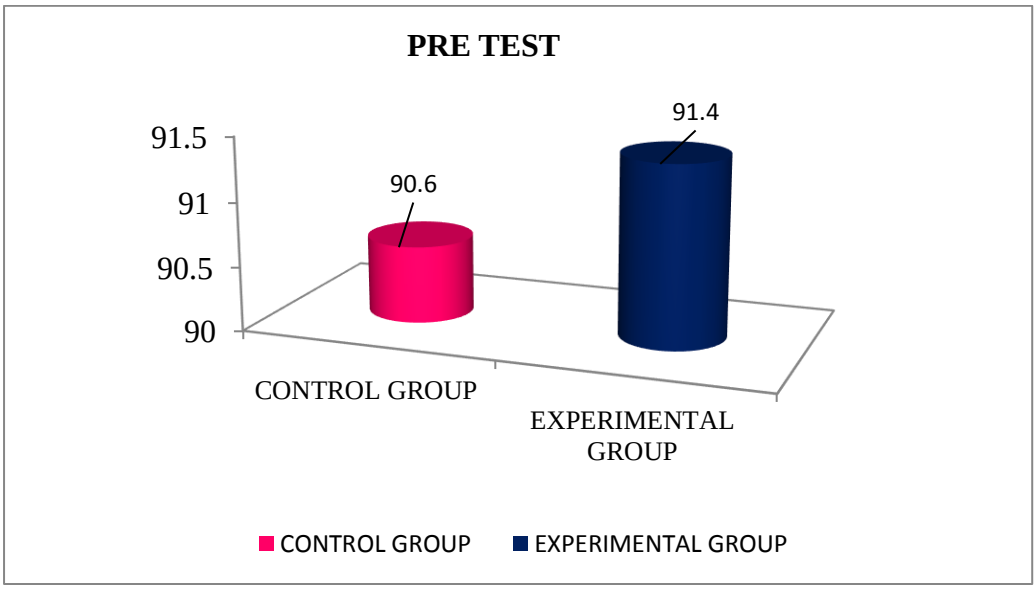


TABLE 3.6

Shoulder Flexion ROM Scoring for Control Group & Experimental Group

Outcome measure	Control Group		Experimental Group		Calculated 't' value	P value
	Mean	SD	Mean	SD		
POST TEST	111.60	11.36	141.90	11.46	5.9380	0.0001

GRAPH 3.6

Shoulder Flexion ROM Scoring for Control Group & Experimental Group

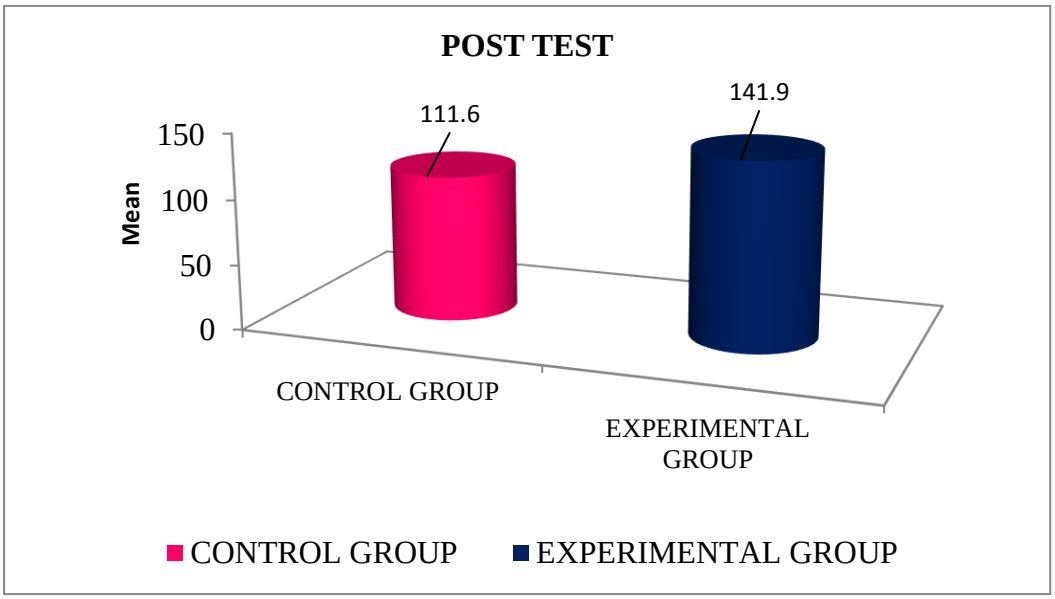


TABLE 4.1

Shoulder Abduction ROM for GROUP A {Control Group}

S.No	Pre test	Post test
1	85	103
2	63	81
3	74	92
4	87	105
5	69	87
6	93	115
7	78	100
8	96	118
9	81	103
10	72	94

TABLE 4.2

Shoulder Abduction ROM Scoring for Control Group

Outcome measure	Control Group	Mean	SD	Calculated 't' value	P value
ABDUCTION	**PRE TEST**	79.80	10.61	4.0137	0.0008
	POST TEST	99.80	11.65		

GRAPH 4.2

Shoulder Abduction ROM Scoring for Control Group

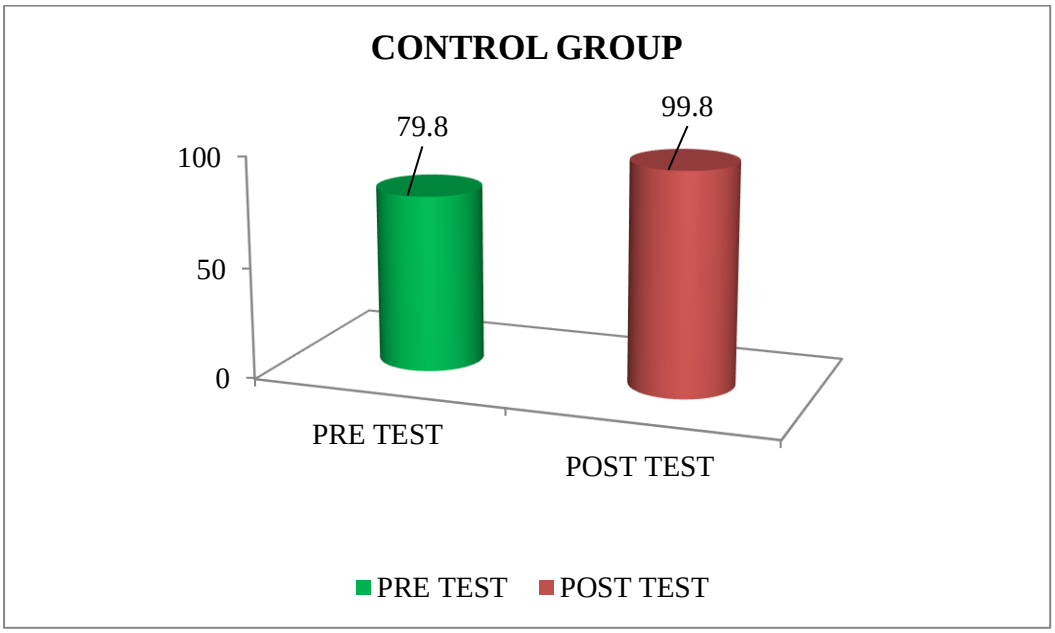


TABLE 4.3

Shoulder Abduction ROM for GROUP B {Experimental Group}

S.No	Pre test	Post test
1	71	116
2	80	125
3	62	107
4	93	138
5	77	122
6	84	135
7	68	119
8	99	150
9	75	126
10	86	137

TABLE 4.4

Shoulder Abduction ROM Scoring for Experimental Group

Outcome measure	Experimental Group	Mean	SD	Calculated 't' value	P value
ABDUCTION	**PRE TEST**	79.50	11.37	8.9476	0.0001
	POST TEST	127.50	12.59		

GRAPH 4.4

Shoulder Abduction ROM Scoring for Experimental Group

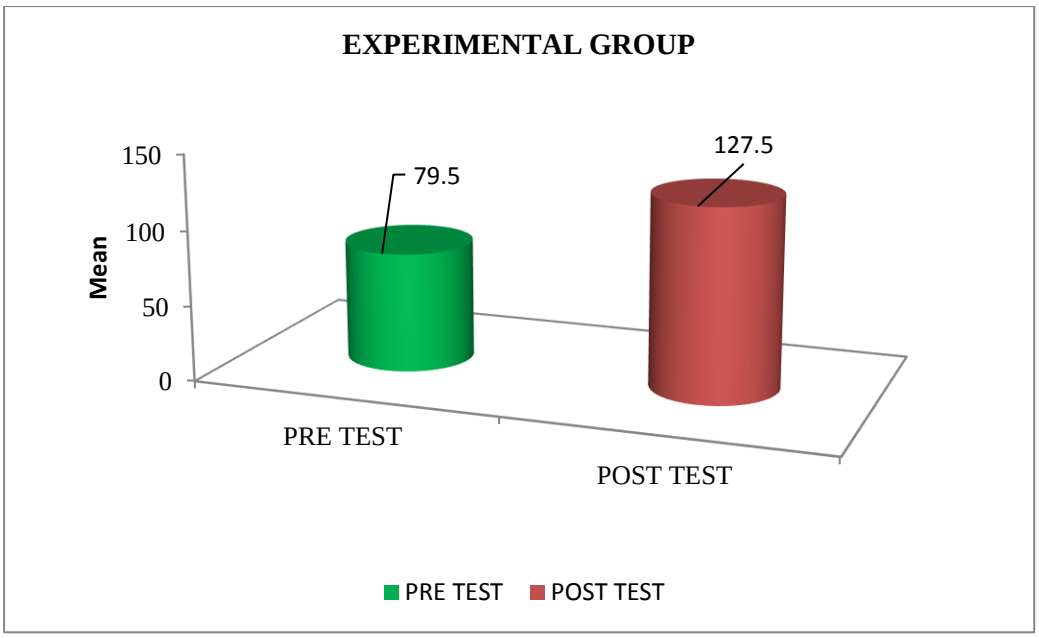


TABLE 4.5

Shoulder Abduction ROM Scoring for Control Group & Experimental Group

Outcome measure	Control Group		Experimental Group		calculated 't' value	P value
	Mean	SD	Mean	SD		
PRE TEST	79.80	10.61	79.50	11.37	0.0610	0.9520

GRAPH 4.5

Shoulder Abduction ROM Scoring for Control Group & Experimental Group

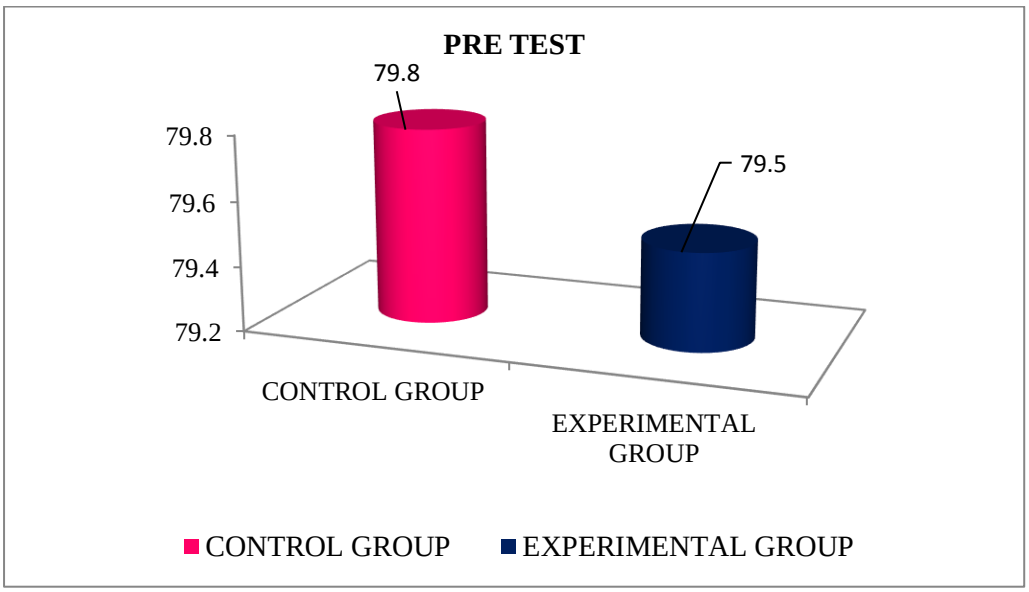


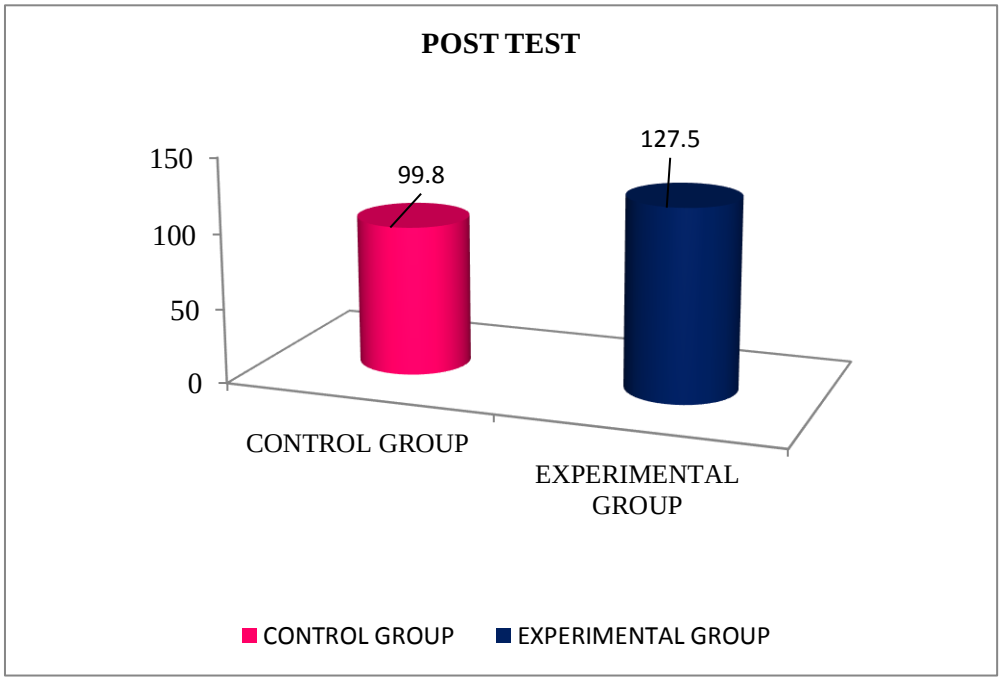
TABLE 4.6

Shoulder Abduction ROM Scoring for Control Group & Experimental Group

Outcome measure	Control Group		ExperimentalGroup		Calculated 't' value	P value
	Mean	SD	Mean	SD		
POST TEST	99.80	11.65	127.50	12.59	5.1066	<0.0001

GRAPH 4.6

Shoulder Abduction ROM Scoring for Control Group & Experimental Group



5. DISCUSSION

- This study was aimed to evaluate the level of pain diminished and range of motion increased and improvement in functional activity of shoulder joint through the application of conventional physiotherapy and shoulder counter traction along with conventional physiotherapy for 10 participants in each group. This improvement was measured using universal goniometry, NPRS and OSS score by comparing pre and post interventional readings.

- We focused on manually treating the affected shoulder by joint mobilization incorporating sustained capsular stretching. This was the basis for our method of using the counter traction apparatus for inferior capsular stretching during shoulder mobilization to evaluate its effect on ROM, pain, and shoulder function in a frozen shoulder.

- The difference in function observed in the experimental group can be attributed to three assumptions: (1) the position of mobilization was in the functional position, (2) the use of counter traction, might have had a positive psychological affect on the participants & (3) other soft tissues such as the fascia or ligaments have an influence on functional improvement.

Numerical Pain Rating Scale

- The pain was measured with the help of numerical pain rating scale.
- The paired ‘t’value for scale in the control group participants was 4.5973. There was a significant difference in the outcome measure of control group at the level 0.05% at 14 degrees of freedom.
- The paired ‘t’ value for scale in the experimental group participants was 8.3799. There was a significant difference in the outcome measure of experimental group at the level 0.05% at 14 degrees of freedom.

- The independent ‘t’ value for numerical pain rating scale in controlled group and experimental group participants for pre test was 0.3990. There was no significant difference in the outcome measure in control group and experimental group at the level 0.05% at 28 degrees of freedom.
- The independent ‘t’ value for numerical pain rating scale in controlled group and experimental group participants for post test was 3.7614. There was a significant difference in the outcome measure in control group and experimental group at the level 0.05% at 28 degrees of freedom.

Oxford Shoulder Scale

- The shoulder function was measured with the help of oxford shoulder scale.
- The paired ‘t’ value for scale in the control group participants was 9.6157. There was a significant difference in the outcome measure of control group at the level 0.05% at 14 degrees of freedom.
- The paired ‘t’ value for oxford shoulder scale in the experimental group participants was 4.6475. There was a significant difference in the outcome measure of experimental group at the level 0.05% at 14 degrees of freedom.
- The independent ‘t’ value for oxford shoulder scale in controlled group and experimental group participants for pre test was 0.7380. There was no significant difference in the outcome measure in control group and experimental group at the level 0.05% at 28 degrees of freedom.
- The independent ‘t’ value for oxford shoulder scale in controlled group and experimental group participants for post test was 3.3197. There was a significant difference in the outcome measure in control group and experimental group at the level 0.05% at 28 degrees of freedom.

Shoulder Flexion ROM

- The shoulder flexion range of motion was measured with the help of universal goniometer.
- The paired 't' value for shoulder flexion range of motion in the control group participants was 4.2516. There was a significant difference in the outcome measure of control group at the level 0.05% at 14 degrees of freedom.
- The paired 't' value for shoulder flexion range of motion in the experimental group participants was 10.3461. There was a significant difference in the outcome measure of experimental group at the level 0.05% at 14 degrees of freedom.
- The independent 't' value for shoulder flexion range of motion in controlled group and experimental group participants for pre test was 0.1699. There was no significant difference in the outcome measure in control group and experimental group at the level 0.05% at 28 degrees of freedom.
- The independent 't' value for shoulder flexion range of motion in controlled group and experimental group participants for post test was 5.9380. There was a significant difference in the outcome measure in control group and experimental group at the level 0.05% at 28 degrees of freedom.

Shoulder Abduction ROM

- The shoulder abduction range of motion was measured with the help of universal goniometer.
- The paired 't' value for shoulder abduction range of motion in the control group participants was 4.0137. There was a significant difference in the outcome measure of control group at the level 0.05% at 14 degrees of freedom.

- The paired ‘t’ value for shoulder abduction range of motion in the experimental group participants was 8.9476. There was a significant difference in the outcome measure of experimental group at the level 0.05% at 14 degrees of freedom.
- The independent ‘t’ value for shoulder abduction range of motion in controlled group and experimental group participants for pre test was 0.0610. There was no significant difference in the outcome measure in control group and experimental group at the level 0.05% at 28 degrees of freedom.
- The independent ‘t’ value for shoulder abduction range of motion in controlled group and experimental group participants for post test was 5.1066. There was a significant difference in the outcome measure in control group and experimental group at the level 0.05% at 28 degrees of freedom.
- From the above result and data analysis it is found that, there was significant improvement in experimental group treated with shoulder counter traction along with the conventional physiotherapy than in control group treated with conventional physiotherapy.

6. CONCLUSION

The conclusion of this study was that shoulder counter traction along with conventional physiotherapy [experimental group] were beneficial and have shown significant improvement in increasing range of motion, reduction of pain and have enabled improvement in doing functional activity of shoulder. Participants in the control group also experienced an improvement in functional activity of shoulder, but it was not much significant on comparing it with the experimental group. Thus accepting alternative hypothesis and rejecting null hypothesis. The alternative hypothesis says that ***"There is a significant difference between the conventional physiotherapy [control group] and counter traction along with the conventional physiotherapy [experimental group] on pain, shoulder range of motion and shoulder function in a frozen shoulder".***

6.1 LIMITATION

- Short term bound study
- Smaller number of subjects participated
- Lack of long term follow up
- Comparatively less reliability of measurement tools used
- Particular side [right & left] and stages of frozen shoulder was not taken
- Study did not have a true control [no treatment] to determine the nature course of the disease
- Study did not have follow up after giving counter traction to find its primary outcome
- Study could not show in detail with advanced measurement tools the rationale behind the effect of counter traction on capsular stretching

6.2 RECOMMENDATION

- Larger number of subjects and long term follow up can be included
- Particular stage of frozen shoulder can be taken for the further studies
- The biomechanical rationale behind the effect of counter traction would be studied with appropriate tools

BIBLIOGRAPHY

BOOK REFERENCES

- Carolyn Kisner [2012] Therapuetic exercise foundations and techniques; Jaypee - 6th edition .
- Jayant Joshi [2011] Essentials of orthopaedics and applied physiotherapy; Elsevier - 2nd edition.
- Cynthia C. Norkin [2011] Joint structure and function A comprehensive Analysis; Jaypee - 5th edition.
- B D Chaurasia [2010] Human antomy Regional and applied dissection and clinical; CBS - 5thedition.
- David Magee J [2002] "Orthopaedic Physical Assessment" - 4th edition.
- Edward V Craig [2001] "Clinical Orthopaedics" Churchill Living Stone.
- Dena Gardiner [2005] "The Principles of Exercise Therapy" - 4th edition.
- Natarajan's Textbook of Orthopaedic and Traumatology - 6th edition.
- Edmond Susan L [1993] "Manipulation and Mobilization – Extremity and Spinal Techniques" Mosby publication.
- Maitland G D [1997] "Peripheral Manipulation" Butterworth Heinemann publication - 3rd edition.

JOURNALREFERENCE

- Goyal et al [2013] Combined effect of end range mobilization and mobilization with movement techniques on range of motion and disability in frozen shoulder patients: a randomized clinical trail.
- Asad et al [2013] Comparison of outcome of passive joint mobilization techniques with active assisted pulley exercise in patients with frozen shoulder in improving range of motion.
- Henricus et al [2006] Comparison of high – grade and low – grade mobilization techniques in the management of adhesive capsulitisof the shoulder: randomized control trail.

- Manish et al [2004] Passive exercise coupled with therapeutic activities – a comparative study in the management of frozen shoulder.
- Johnson et al [2007] Effects of anterior versus posterior glide joint mobilization on external rotation range of motion in patient with shoulder adhesive capsulitis.
- Hannafin J A, Chiaia T A [2000] Adhesive capsulitis: a treatment approach.
- Manikandan N et al [2008] Impact of adhesive capsulitis on quality of life in elderly subjects with diabetes: a cross sectional study.
- Dias R, Cutts S, Massoud S [2005] Frozen shoulder.
- Green S et al [2003] Physiotherapy interventions for shoulder pain.
- Jayanta et al [2013] Different mobilization technique in management of frozen shoulder.
- Wim R et al [2000] End –range mobilization techniques in adhesive capsulitis of the shoulder joint: a multiple- subject case report.
- Pieter et al [2015] Passive mobilization after arthoscopic rotator cuff repair is not determental in this early post operative period.

APPENDICES

APPENDIX I

ORTHOPAEDIC EVALUATION FORM

SUBJECTIVE ASSESSMENT

CONTROL GROUP	EXPERIMENTAL GROUP

RIGHT SIDE	LEFT SIDE

Name

Age

Gender

Occupation

Address

IP/OP No

Doctor Reference

Date of Assessment

Chief Complaints

History

- Past Medical History
- Present Medical History
  - Onset
  - Duration
- Surgical History
- Drug History
- Personal History

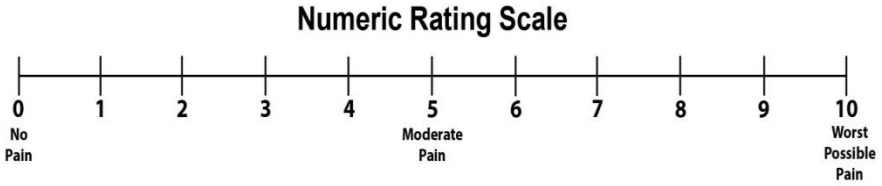
Associated problems if any

Pain Assessment

- Side
- Site

- Type of Pain
- Duration of Pain
- Aggravating factors
- Relieving factors

- Grading of Pain : NPRS [Numerical Pain Rating Scale]



OBJECTIVE ASSESSMENT

ON OBSERVATION

- Body built
- Shoulder Level [Bilaterally]
- Scapular Position [Bilaterally]
- Posture
- Arm Swing during Gait
- Postural changes
- Tropical changes
- Edema

ON PALPATION

- Tenderness
- Warmth
- Swelling

ON EXAMINATION

Vital Signs

- Temperature : degree celsius
- Pulse Rate : beats per minute
- Respiratory Rate : breath per minute
- Blood Pressure : mm/Hg

Musculoskeletal System

- Gleno Humeral Rhythm
- Range of Motion

JOINT	RIGHT	LEFT
CERVICAL FLEXION		
CERVICAL EXTENSION		
CERVICAL ROTATION		
CERVICAL LATERAL FLEXION		
SHOULDER FLEXION		
SHOULDER EXTENSION		
SHOULDER ABDUCTION		
SHOULDER ADDUCTION		
SHOULDER INTERNAL ROTATION		
SHOULDER EXTERNAL ROTATION		

- Muscle Power

JOINT	RIGHT	LEFT
CERVICAL FLEXOR		
CERVICAL EXTENSOR		
CERVICAL ROTATOR		
CERVICAL LATERAL FLEXOR		
SHOULDER FLEXOR		
SHOULDER EXTENSOR		
SHOULDER ABDUCTOR		
SHOULDER ADDUCTOR		
SCAPULAR ELEVATOR		
SCAPULAR DEPESSOR		
SCAPULAR PROTRACTOR		
SCAPULAR RETRACTOR		

- End Feel

Sensation

- Superficial Sensation
- Deep Sensation

Special Test

- Drop arm test [rotator cuff]
- Anterior drawer test [anterior instability]
- Neer impingement test [rotator cuff]
- Keibler test [SLAP lesion]
- Apley scratch test [rotator cuff]

- Allen test [vascular instability]
- Cross over impingement test [acromioclavicular joint]
- Feagin test [inferior joint instability]
- French horn test [rotator cuff]
- O'Brien test [glenoid labrum]
- Painful arc test [impingement of supraspinatus tendon]
- Shoulder abduction test [cervical facet joint impingement]
- Shear test [acromioclavicular joint]
- Posterior drawer test [posterior instability]
- Yergason's test [biceps tendon]
- Hawkins kennedy test [rotator cuff]
- Clunk test [joint instability]
- Apprehension test [anterior instability]

Diagnosis

Problem List

Aims

Management

Home – Exercise Program

APPENDIX II

INFORMED CONSENT FROM

I, Mr./Mrs. _____ Voluntarily agree to participate in the research study conducted on "The effectiveness of sustained stretching of the inferior capsule in the management of a frozen shoulder" I was explained about the procedure of the study and I understood the requirements and benefits of the study. I surely gives consent to participate in the study.

The evaluator has explained me the procedure in detail.

Participant's signature Signature of the evaluator

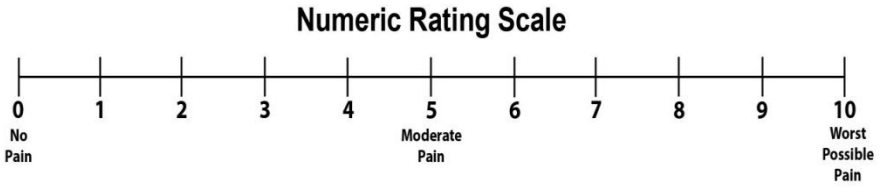
Place: Coimbatore

Date:

APPENDIX III

NUMERICAL PAIN RATING SCALE [NPRS]

Numerical pain rating scale is 11 point numerical scale format in a horizontal line.



Numerical Pain Rating Score

- '0' represents no pain
- '10' represents pain as bad as you can imagine

APPENDIX IV

OXFORD SHOULDER SCALE [OSS]

Oxford Shoulder Scale is a 12 item self reported questionnaire which provides reliable, valid and responsive data regarding the subject's perception of shoulder problems.

Tick (✓) one box for every question.

1. During the last 6 months...
How many times has your shoulder slipped out of joint (or dislocated)?

Not at all in 6 months	1 or 2 times in 6 months	1 or 2 times per month	1 or 2 times per week	More often than 1 or 2 times/week
☐	☐	☐	☐	☐

2. During the last 3 months...
Have you had any trouble (or worry) with putting on a T-shirt or pullover because of your shoulder?

No trouble/no worries	Slight trouble or worry	Moderate trouble or worry	Extreme difficulty	Impossible to do
☐	☐	☐	☐	☐

3. During the last 3 months...
How would you describe the **worst** pain you have had from your shoulder?

None	Mild ache	Moderate	Severe	Unbearable
☐	☐	☐	☐	☐

4. During the last 3 months...
How much has the problem with your shoulder interfered with your usual work? (including school or college work, or housework)

Not at all	A little bit	Moderately	Greatly	Totally
☐	☐	☐	☐	☐

5. During the last 3 months...
Have you avoided any activities due to worry about your shoulder – feared that it might slip out of joint?

No, not at all	Very occasionally	Some days	Most days or more than one activity	Every day or many activities
☐	☐	☐	☐	☐

6. During the last 3 months...
Has the problem with your shoulder prevented you from doing things that are important to you?

No, not at all	Very occasionally	Some days	Most days or more than one activity	Every day or many activities
☐	☐	☐	☐	☐

7. During the last 3 months...
How much has the problem with your shoulder interfered with your social life? (including sexual activity – if applicable)

Not at all	Occasionally	Some days	Most days	Every day
☐	☐	☐	☐	☐

8. During the last 4 weeks...
How much has the problem with your shoulder interfered with your sporting activities or hobbies?

Not at all	A little/ occasionally	Some of the time	Most of the time	All of the time
☐	☐	☐	☐	☐

9. During the last 4 weeks...
How often has your shoulder been 'on your mind' – how often have you thought about it?

Never, or only if someone asks	Occasionally	Some days	Most days	Every day
☐	☐	☐	☐	☐

10. During the last 4 weeks...
How much has the problem with your shoulder interfered with your ability – or willingness – to lift heavy objects?

Not at all	Occasionally	Some days	Most days	Every day
☐	☐	☐	☐	☐

11. During the last 4 weeks...
How would you describe the pain you usually had from your shoulder?

None	Very mild	Mild	Moderate	Severe
☐	☐	☐	☐	☐

12. During the last 4 weeks...
Have you avoided lying in certain positions, in bed at night, because of your shoulder?

No nights	Only 1 or 2 nights	Some nights	Most nights	Every night
☐	☐	☐	☐	☐

Oxford Shoulder Score

- Stage 1 [range 0-19] indicative of severe shoulder arthritis
- Stage 2 [range 20-29] indicative of moderate to severe shoulder arthritis
- Stage 3 [range 30-39] indicative of mild to moderate shoulder arthritis
- Stage 4 [range 40-49] indicative of satisfactory joint function

APPENDIX V

TREATMENT TECHNIQUE

A) MOBILIZATION WITH COUNTERTRACTION

The shoulder counter traction apparatus constitutes two overhead pulleys on a wall fixed L shaped steel frame [2.5 feet in length] with free weights fixed at one end of rope [3 m in length] passing through the pulleys while the other free end of the rope is connected to the distal end of the subject's affected upper limb which is covered with a cuff and medium sized bandage just above the elbow. The ends of the rope are connected with an S hook. The patient is positioned comfortably to sit upright in a chair with a back seat, directly below the pulleys. Weight is added based on the body weight cutoff of 60 kg. If the patient weight more than the cutoff value [>/= 60 kg], 3 kg was set as the distracted load, whereas if the patient weight less than the cutoff value [<60 kg], 2 kg was set as the distracted load. After the distraction provided by the counter traction, mobilization of the gleno-humeral joint is given manually using postero-anterior glides, followed by gentle rotator passive range of motion of the gleno-humeral joint in internal and external rotation.

Mobilization glides was given in Grades of 1 to 4 depending on the restriction level based on the Maitland classification system. To improve the flexion range, the patient is seated facing opposite the hanging weights. To improve the abduction range, the patient is seated parallel to the hanging weights in such a way that the affected shoulder is away from the weights. The patient is permitted to have a rest period for approximately 3 minutes between the flexion and abduction mobilizations.

The therapist's position for the mobilizations was standing on the affected side of the subject, with the thenar eminence of the mobilizing hand closer to the joint line, at the greater tuberosity of the humerus to provide the glides. The non-mobilizing hand was holding the distal part of the humerus to provide appropriate distraction at the gleno-humeral joint and to aid in performing rotator passive range of motion.

B) ULTRASOUND

Ultrasound Parameters

- Duty Cycle – 100%
- Frequency – 1MHz
- Intensity – 1.5W/cm^2
- Duration – 5 minutes

Procedure

- Ultrasound was given to the shoulder joint
- The intensity knob is zero and the machine parameters are set first
- The ultrasound gel is applied over the treatment head and placed over the shoulder joint
- By rotating the head of machine is switched ON and the intensity is adjusted to 1.5W/cm2 for 5 minutes per session

C) MOBILIZATION

Maitland's Grading mobilization [Oscillation Technique]

- Grade I – small amplitude rhythmic oscillation performed at beginning range
- Grade II – large amplitude rhythmic oscillation performed within the range not reaching the limits
- Grade III – large amplitude rhythmic oscillation performed till limit stressed into tissue resistance
- Grade IV – small amplitude rhythmic oscillation limits at available motion and stressed tissue limit
- Grade V – small amplitude high velocity thrust technique, requires advanced training

Mobilization Procedure

Inferior glide(increase abduction)

- Position of patient is supine, with arm abducted to the end of its available range. External rotation of the humerus should be added to the end range position as the arm approaches and goes beyond 90 degree.
- Position of therapist and hand placement: Therapist stands facing the patient's feet and stabilizes the patient's arm against the trunk with the hand farther from the patient. Place the web space of the other hand just distal to the acromion process on the proximal humerus.
- Mobilizing force was given with the hand on proximal humerus, glide the humerus in an inferior direction with respect to the scapula.

Posterior Glide(increase horizontal adduction)

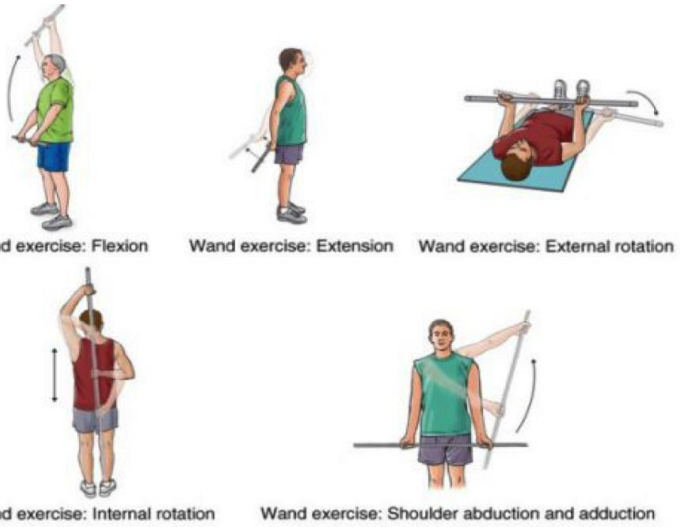
- Indication is to increase posterior gliding when flexion approaches 90 degree; to increase horizontal adduction.
- Position of patient is supine, with the arm flexed 90 degree and internally rotated and with elbow flexed. The arm may also be placed in horizontal adduction.
- Therapist hand place padding under the scapula for stabilization. Place one hand across the proximal surface of the humerus to apply a grade distraction Place your hand over the patient's elbow. A belt placed around your pelvis and the patient's humerus may be used to apply the distraction force.
- Mobilizing force was gliding the humerus posteriorly by pushing down at the elbow through the long axis of the humerus.

APPENDIX VIII

HOME PROGRAM EXERCISE

PENDULUM EXERCISES: Bending over at the waist and balancing with the "good arm" let the stiff side relax and swing with gravity: a) circle inward, b) circle in the opposite direction, c) swing toward forward and backward, d) swing sideways.

WAND EXERCISE: Hold stick with both hands and raise both hands overhead in sitting and standing position.



Wand exercise: Flexion

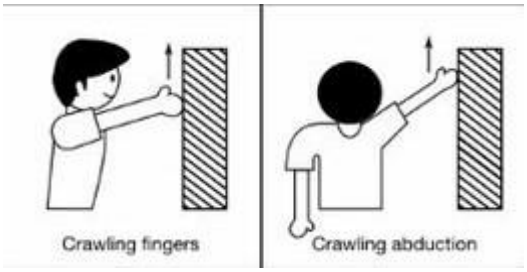
Wand exercise: Extension

Wand exercise: External rotation

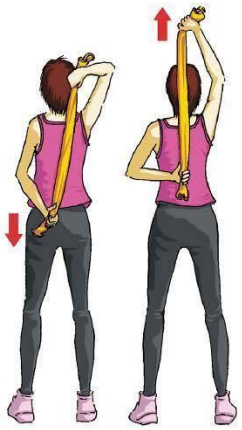
Wand exercise: Internal rotation

Wand exercise: Shoulder abduction and adduction

WALL CLIMBING EXERCISE: Stand near a wall and slowly “walk” your fingers up the wall facing forward and sideways.

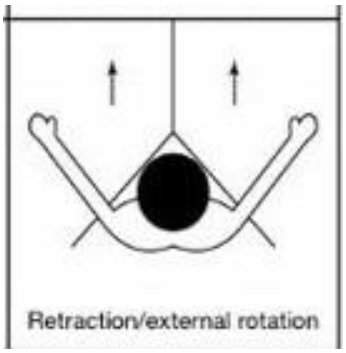


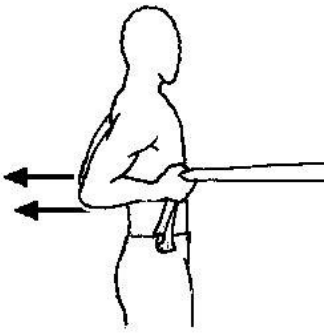
TOWEL STRETCH: Hold towel with hand behind the back and move hands upward and downward.



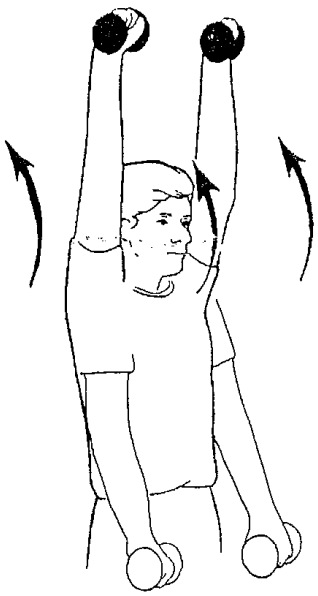
THERABAND EXERCISE: one end of theraband tie on stand and another end of theraband tie on stiff hand then move in flexion, extension, abduction, adduction, internal and external rotation.

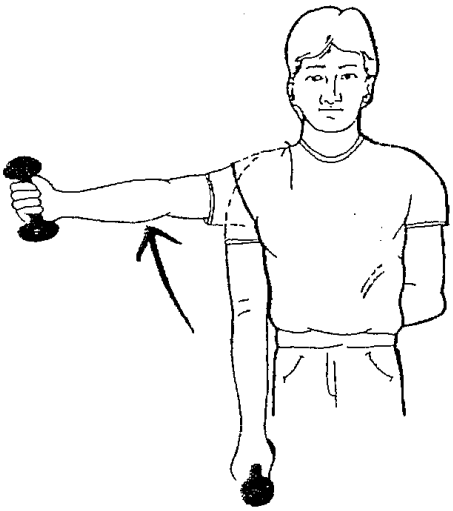
SCAPULAR EXERCISE: Place your hand on the wall then without bending elbow push the wall. Hold two ends of theraband on both hands around stand then pull on both sides.





FUNCTIONAL EXERCISE: Stand holding object in stiff hand then raise arms up over head as far as you can in flexion and abduction direction.





APPENDIX IX

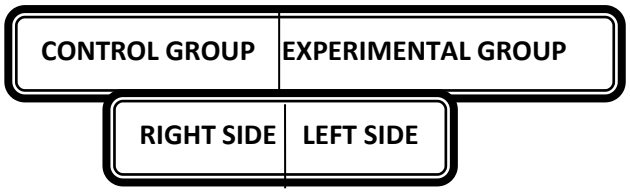
FOLLOW UP CHART

Name

Age

Gender

Diagnosis



EVALUATION	Pre test – 1st day	1 week	2 week
NPRS			
OSS			
SHOULDER FLEXION ROM			
SHOULDER ABDUCTION ROM			